Bilateral Aneurysms of the Internal Carotid Artery

Successful Surgical Approach in One Stage

ROBERT D. WEYAND, *M.D.*, E. F. SCHMERL, *M.D.*, and JAMES L. RHEE, *M.D.*, Oakland

• **When intracranial aneurysm is suspected, carotid arteriogram should be done not only on the suspected side but always on both sides. Without surgical intervention the prognosis of bilateral aneurysms is notoriously poor.**

With the aid of hypothermic anesthesia it is now possible to operate on both sides in a single procedure. This was demonstrated in a case in which both carotid arteries were simultaneously occluded twice during the surgical repair of bilateral carotid aneurysms. Occlusion was done once for eight minutes and once for ten minutes, without clinical evidence of brain damage.

BECAUSE OF THE grave prospect of recurrence, the prognosis is poor in cases in which intracranial aneurysms of the supraclinoid portion of the internal carotid arteries are present after subarachnoid hemorrhage. Ask-Upmark and Ingvar[2] in a review of more than 500 cases of subarachnoid hemorrhage noted that the mortality rate was 60 per cent, 20 per cent of patients were disabled and 20 per cent recovered. Of 191 patients with subarachnoid hemorrhage reported upon by Hyland,[8] 100 died within six months after the first attack, 70 within two weeks. According to Cloake,[5] the high proportion of early recurrence of bleeding was stressed by Falconer and is of great importance in assessing indications for operation.

Prompt treatment of residual aneurysms can greatly reduce the hazard. Seventy-three cases of surgically treated aneurysms were surveyed by Bassett and co-workers,[3] who reported that the mortality rate associated with ligation of the cervical carotid artery was low (3.4 per cent) and that with that operation there was a high incidence of functional recovery from transient postoperative hemiplegia. With intracranial ligation, the mortality rate was 40 per cent.

When intracranial aneurysms occur bilaterally, the surgeon faces a baffling problem. Ideally both lesions should be repaired without disturbing the cerebral circulation. Only recently Seltzer and Hurteau[10] reported a case of bilateral aneurysms in a 47-year-old white woman. Both lesions originated from the carotid arteries within the cavernous sinus. The lesions were symmetric but only the left one caused symptoms. The patient had hypertension. She had had a left-sided headache of three weeks' duration, followed, 18 days later, by medial deviation of the left eye. At operation, the left carotid artery was surgically occluded proximally and distally from the aneurysm. The aneurysm on the right was let alone.

Bilateral aneurysms may occur more frequently than is generally believed. Dandy[6] reported that in eight of thirty-nine patients with internal carotid aneurysms, the lesions were of bilateral occurrence.

Submitted January 30, 1959.

In fatal cases, he noted, the duration of symptoms was usually very short—less than five weeks in all except one case in which symptoms were present for seven months.

In contrast, Alpers and co-workers[1] observed only one bilateral case among 75 verified cases of aneurysms of the internal carotid artery. That was the case of a woman 45 years of age with hypertension and premenstrual headaches, ophthalmoplegia on the left side and paralysis of the external rectus muscle on the right side. A bruit was heard over the entire head. On arteriographic examination, a carotid arteriocavernous sinus fistula was seen on the right side and a saccular aneurysm on the left. The patient was discharged without operation. Five weeks later the left eye paralysis was still present and that in the right eye was somewhat diminished. The bruit was audible as before.

The authors said that the clinical features of bilateral aneurysms of the internal carotid artery vary from case to case.

Among 73 cases of multiple aneurysms reported by Bassett and co-workers[3] there was only one in which there were bilateral lesions. In that case, cervical ligation was done successfully on one side, but, 46 months later, when the contralateral aneurysm was discovered, rupture of the aneurysm occurred when a surgical clip was placed at the neck of the lesion, and carotid ligation had to be done. The patient, dependent on vertebral arterial blood supply alone, died.

Cloake[5] studied 120 cases of aneurysms in 114 patients observed at the Neurosurgical Clinic in

Stockholm from 1932 to 1951. All the aneurysms were located within the cranium. In 30 of the cases there were supraclinoid lesions. Bilateral occurrence was not mentioned at all.

One of the first cases reported appears to be one described by Friedrich[7] in 1934. A 58-year-old woman had had partial thyroidectomy for toxic goiter at age 40 and at age 51 had had radial resection of the right maxilla with removal of the right eye because of a malignant tumor. At 53 years of age she complained of headache and dizziness. Five years later a tumor of the pituitary gland was

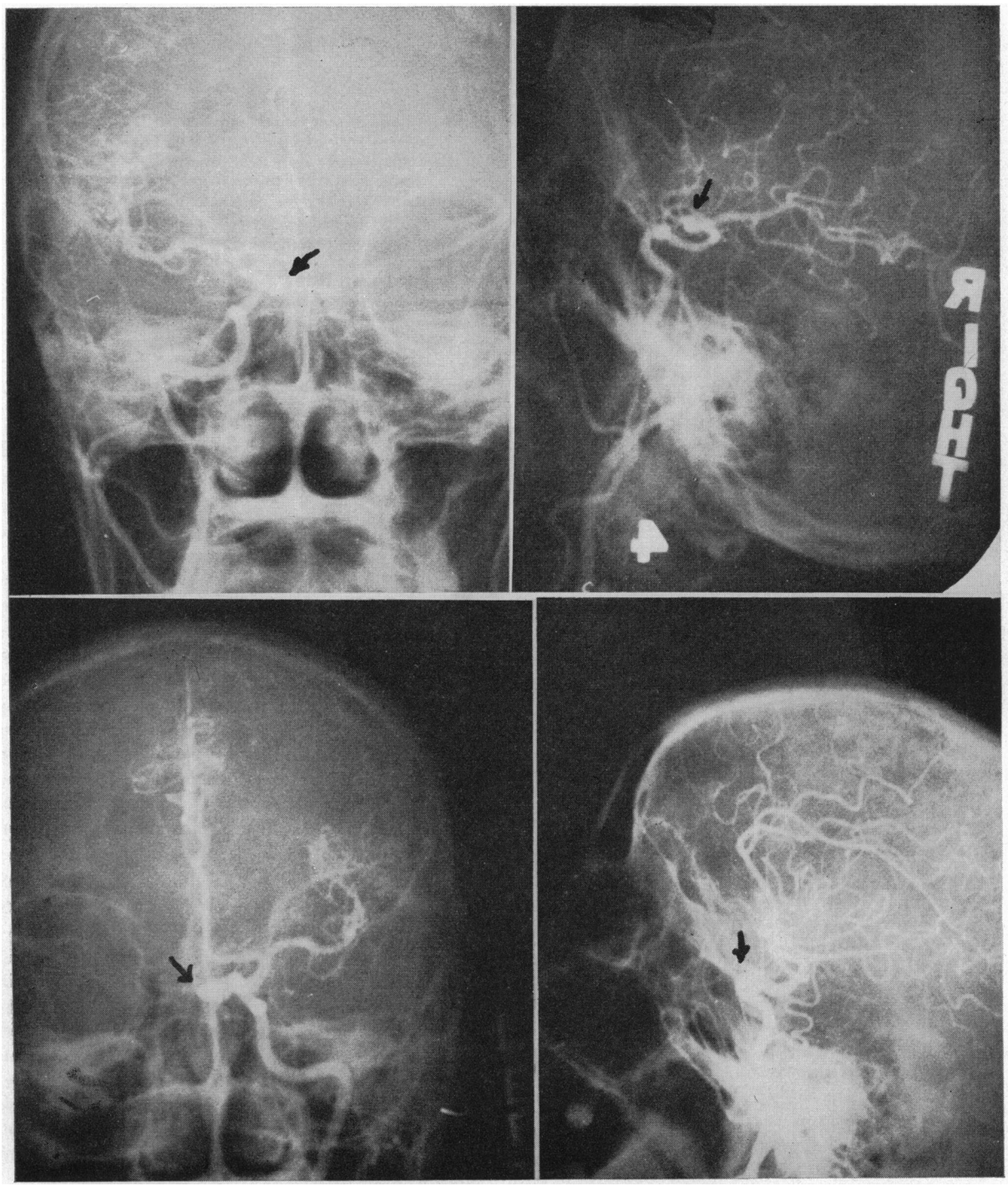

Figure 1.—Lateral and anterior-posterior arteriograms before operation. Arrows point to the right and the left aneurysm. The two upper films were taken with the left side injected, the two lower films after injection on the right side.

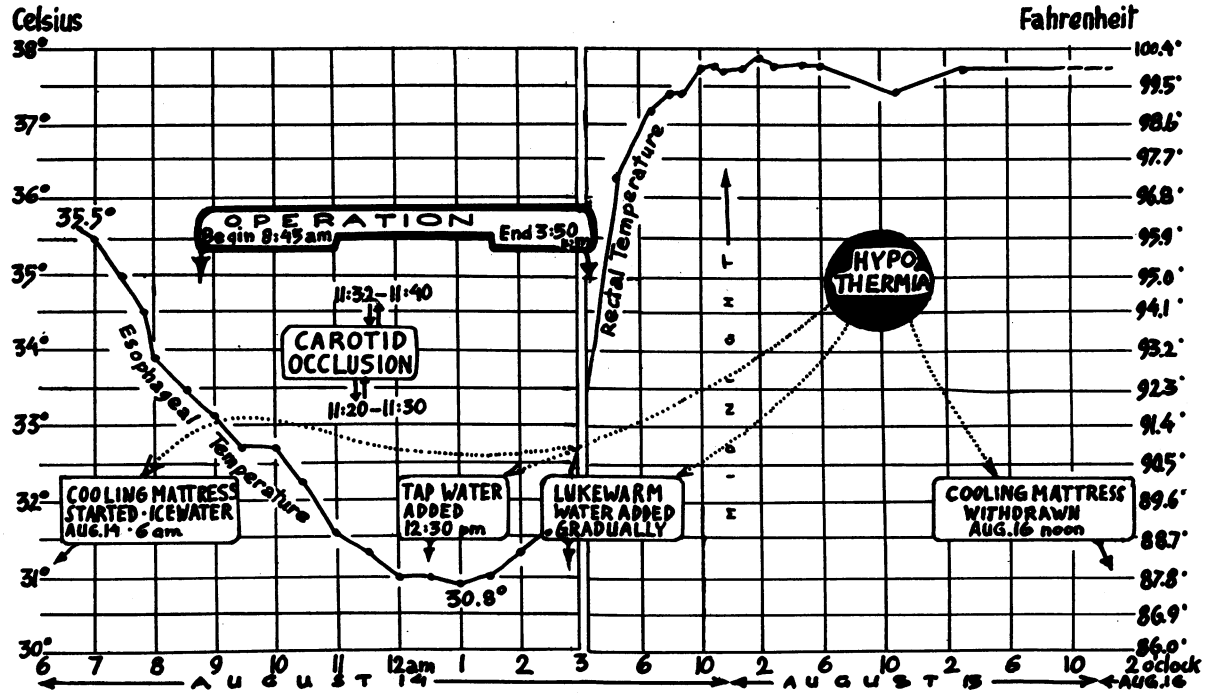

Chart 1.—Timetable shows the effect of hypothermia on the body temperature. Esophageal temperatures were registered by a Yellow Springs Thermister thermometer. Note the timing of simultaneous bilateral carotid occlusions.

suspected when she had severe headaches and diminished vision. Operation was done but the patient died soon afterward of uncontrollable hemorrhage. There was an aneurysm 5 cm. in diameter in the right side of the cranium and another smaller aneurysm on the left. Both originated from the internal carotid arteries. Friedrich considered them to be of traumatic origin.

In a case reported by Bozzoli[4] in 1937, a man 58 years of age had aneurysms of both internal carotid arteries. The patient died of bronchopneumonia before surgical treatment could be carried out.

Minton[9] reported the case of a 60-year-old woman with complaint of sudden dizziness followed by severe headaches, vomiting and loss of consciousness. Arteriograms demonstrated two aneurysms on the right side, one at the cavernous sinus and a larger one, surrounded by a hematoma, at the origin of the posterior communicating artery. On the left side was a large fusiform aneurysm of the carotid syphon. Surgical treatment was contraindicated. The patient did rather well on bedrest and sedation, but three weeks later, she died of a sudden second hemorrhage. At autopsy evidence was found that the first symptoms had been caused by rupture of an aneurysm of the right internal carotid artery and that the later fatal bleeding had come from rupture of an aneurysm of the left internal carotid artery.

The surgical attempt to approach both sides in one stage has been considered almost forbiddingly hazardous because it may necessitate the simultaneous occlusion of both carotid arteries in the neck. In the following case, this procedure, done with the help of hypothermia was remarkably well tolerated, and the patient recovered without significant postoperative signs of even transient cerebral damage.

REPORT OF A CASE

A 43-year-old negro housewife, admitted to hospital on August 4, 1957, had been in apparent good health until August 3, when she lost consciousness while washing her car on a hot day. When she awoke she was lying on her back on the sidewalk and had a severe headache. Taken by ambulance to an emergency hospital, she was examined and then permitted to go home. Severe occipital headache continued. The next morning nausea and vomiting developed and the patient was sent to a hospital.

The patient was obese. She was alert and cooperative. The blood pressure was 170/90 mm. of mercury. Nuchal rigidity was noted. The Kernig sign was present bilaterally. Tenderness was noted in the right occipitotemporal area. The grip was weaker in the right hand than the left. There was hypesthesia to touch and pinprick over the right upper face and side of the head. The cerebrospinal fluid pressure was found to be 350 mm. of water and the fluid was bloody.

Headaches and vomiting continued. On August 8,

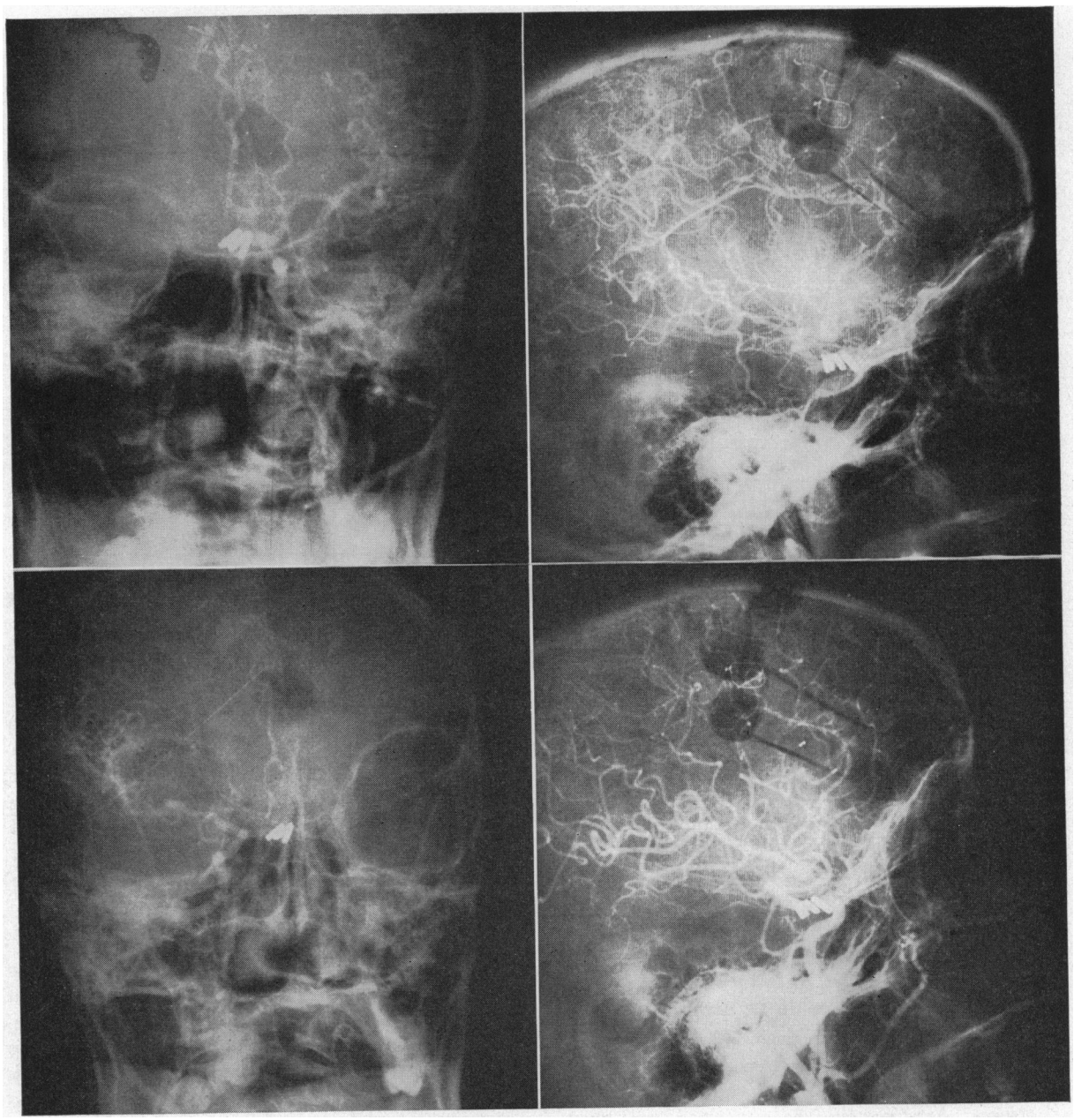

Figure 2.—Lateral and anterior-posterior arteriograms after operation. The upper films were taken with the left side injected, the lower films with the right.

carotid angiograms showed two aneurysms extending medially from the supraclinoid portion of each carotid artery (Figure 1). Numbness of the right side of the face and of the right forearm and hand was noted.

On August 14 general hypothermic anesthesia was started with the aid of a cooling mattress. When the body temperature, measured with an esophageal thermometer, was below 34° C., operation was begun. A bifrontal bone flap was elevated and the anterior sagittal sinus and falx cerebri were sectioned. The aneurysms were approached by elevating the right frontal lobe while cerebrospinal fluid was withdrawn from the lumbar region. Both aneurysms were identified. They were touching each other. During the attempt to dissect the right aneurysm from its bed, the left aneurysm ruptured at its fundus. Carotid arteries were occluded in the cervical region (see timetable, Chart 1) and bleeding was greatly reduced. While the left aneurysm was being dissected free, both carotid arteries were occluded simultaneously for ten minutes. After this, the arteries were released for two minutes and then occluded again for eight minutes. During this

time the left aneurysm was occluded to an area flush with the left carotid artery by means of four broad silver clips. Following this, the right aneurysm was dissected free and a 2-0 silk ligature tied about its base. The aneurysm decreased in size immediately. The esophageal body temperature reached 31.0° C.

The postoperative course was quite uneventful. For two days the patient remained on the cooling mattress which was kept at a temperature of 34° C. The maximum body temperature was 38.9° C. rectally.

The patient was awake, alert, and able to talk in the immediate postoperative period. For several days she complained of headache. With the exception of leukocytosis—leukocytes numbered 23,000 per cu. mm.—results of laboratory examinations were within normal limits during the postoperative period. On August 23, nine days after the operation, bilateral carotid angiograms showed a normal vascular pattern (Figure 2).

On August 30, the patient was ambulatory and felt well. Except for anosmia there were no neurological abnormalities. The patient resumed her normal activities and remained remarkably well with the exception of minor complaints of headache and tenderness at the site of the cervical incision. In December the patient had a mild head injury when struck by a falling can of food. She was not unconscious but complained of tenderness and headache. By February, 1958, she was again feeing well and at last observation was performing her normal activities.

COMMENT

The importance of visualization of both carotid artery systems in a patient with suspected intracranial aneurysms is apparent from the review of the incidence of bilateral aneurysms. Even in clinically unilateral cases, it is advisable to do arteriography on both sides. The history and findings alone are usually not reliable in determining the presence or absence of an aneurysm on the other side.

The rather poor prognosis in patients with bilateral aneurysms reported in the literature should be noted. It justifies early attempts at ligation. The problems of direct surgical attack to the bilateral intracranial aneurysms are, of course, similar to those encountered in the case of solitary aneurysm. The use of hypothermic anesthesia was perhaps of decisive import in the present case. It appears to have helped in the control of cerebral edema at the time of operation. Above all, it enabled us to consider seriously simultaneous bilateral approach. Reducing the oxygen demand in the brain, it allowed a longer safe period of carotid occlusion. We believe that the continuation of the use of the cooling mattress into the postoperative period helped control the usual postoperative hyperthermia and reduce postoperative cerebral edema.

ACKNOWLEDGMENT: Postoperative cooling was suggested by Drs. Norman Barnstein and Marshall Skaggs of Sacramento, who put their hypothermic equipment at our disposal.

411 Thirtieth Street, Oakland 9 (Weyand).

REFERENCES

1. Alpers, B. J., Schlezinger, N. S., and Tassman, I. M.: Bilateral internal carotid aneurysm involving the cavernous sinus, A.M.A. Arch. of Ophthalmology, 46:403-407, 1951.

2. Ask-Upmark, E., and Ingvar, D.: A follow-up examination of 138 cases of subarachnoid hemorrhage, Acta Med. Scand., 138:15-31, 1950.

3. Bassett, R. C., List, C. F., and Lemmen, L. J.: Surgical treatment of intracranial aneurysm, Surgery, Gynec. Obstet., 95:701-708, 1952.

4. Buzzoli, A.: Aneurisma Bilaterale della Carotide Interna, Revista Oto-Neuro-Oftalmologica, 14:304-316, 1937.

5. Cloake, P. C. P.: The pathology of diagnosis and treatment of intracranial saccular aneurysms, Proceedings of Royal Society of Medicine, 45:291-302, 1952.

6. Dandy, W. E.: Intracranial Arterial Aneurysms, Ithaca, N. Y., Comstock Publishing Co., Inc., 1944, see page 23.

7. Friedrich, G.: Traumatisches Sackfoermiges Aneurysma der Rechten und Linken Arteria Carotis Interna nach Alter Kieferresektion, Zentralblatt fuer Chirurgie, 61:1586-1592, 1934.

8. Hyland, H. H.: Prognosis in spontaneous subarachnoid hemorrhage, Arch. Neurol. Psychiat., Chicago, 63:61-78, 1950.

9. Minton, J.: Intracranial aneurysms of the internal carotid and cerebral arteries, Ophthalmological Transactions, London, 75:81-100, 1955.

10. Seltzer, J., and Hurteau, E. F.: Bilateral symmetrical aneurysms of internal carotid artery within the cavernous sinus, J. of Neurosurgery, 14:448-451, 1957.